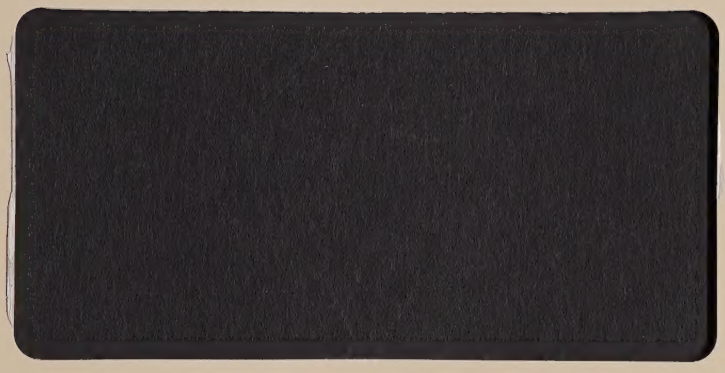

CXR telcom

OPERATION MANUAL

MODEL 704A

WIDEBAND TEST SET

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CXR Telcom Corporation
521 Charcot Avenue, San Jose, CA 95131
(408) 435-8520 - Telex 284-684 - Fax (408) 435-1276

SECTION 1 - INTRODUCTION

1.1 Manual Application

This manual describes the use of the CXR Telcom 704A series of Wideband Test Sets. These sets are available in two models, designated as follows:

704A Basic wideband set measures level, frequency, noise, and impulse noise.
704A2 Provides the same functions as the basic set plus P/AR and four-wire return loss.

These sets are normally equipped with the 705A Dial and Hold Unit and may optionally be equipped with the 710B Network Access Unit. The use of these appliques is covered in detail in section 4 of this manual.

1.2 General Description

The 704A test sets are compact portable sets which are used to measure analog transmission parameters. The frequency range provided covers voice frequency, program channel, and wideband data applications. In addition to level/frequency and noise measurements, both models also include three-level impulse noise test capability. The 704A2 is equipped with an additional board which provides P/AR and four-wire return loss measurement.

Noise-to-ground measurements can be made using the optional Noise-to-Ground Adaptor.

The 704A has separate transmitter and receiver controls which provide versatile two- and four-wire test arrangements. Dual LED displays are provided for the simultaneous reading of frequency and level.

1.3 Model 710B Network Access Unit

The 710A Network Access Unit is an applique which is suitable for installation as a front cover on the 704A case. It provides features needed to access two and four-wire dial-up or special service lines. These include loop pulsing (dial or DTMF), REN 3 ringer load, line holding with loop current detection, ground-start operation, battery feed (C.O. emulation), 20 Hz ring generation, and E & M pulsing (types I thru V).

1.4 Power Requirements

The model 704A is powered by internal rechargeable batteries and may also be operated from 120 or 240 VAC commercial power. The model 710A NAU also has internal batteries but some functions require external AC power.

SECTION 2 - DESCRIPTION

2.1 704A Front Panel Controls and Indicators

The 704A front panel controls and indicators are shown in detail in figure 1. Each item is described in the following table, listed by the reference number which appears in the figure. The description is divided into five functional groups; Display, Receive, Transmit, Line Interface, and Power.

Figure 1. 704A Front Panel

Reference	Name	Function
Display		
1		**Frequency Display:** The right-hand (green) display shows frequency, in kHz. Resolution is 1 Hz to 4 kHz and 10 Hz above this value.
2		**Level Display:** The left-hand (red) display shows the value of the parameter being measured. Signal level is displayed in units of dBm, noise in dBrn, and P/AR in units. During P/AR and Return Loss testing, this display shows the measured value if the signal level is within measurement range and shows a (-) or (+) during an out-of-range condition.
3		**Display Select:** This three positon switch connects the internal measuring circuits to either the receiver (RCV) or to the transmitter (TRMT) or configures the receiver to measure P/AR. When the latter is selected, only the RCV signal can be measured.

Reference **Name** **Function** *(continued)*

4 **Function Select:** This up/down step control selects the test function of the set or the impulse noise counts to be displayed. The LED indicators in the left hand display area show the selected function, as follows;

LEVEL; An averaging detector and flat response are selected. The measured value is displayed in dBm.

NOISE; A RMS detector and a noise shaping filter are selected. The measured value is displayed in dBrn.

NOTCH NOISE; A RMS detector, a noise shaping filter, and a 1010 Hz band elimination filter are selected. The measured value is shown in dBrn.

ERL/SRL/SRH; The transmitter and receiver are both configured to make a return loss test. The position of the LED cursor indicates which transmit signal shaping filter is in use. (Applicable to 704A2 model only).

TIME; Indicates elapsed time of Impulse Noise test.

IMPLS, 0/+4/+8; These three counters show the number of impulses which have crossed the threshold setting, 4 dB above the threshold, and 8 dB above the threshold.

P/AR; The peak-to-average ratio of the received signal is measured.

Note: The displays are blanked when TRMT and either NOISE mode are selected simultaneously. This does not mute the transmitter.

Receiver

5 **Filter select:** This two position switch selects either a complex noise weighting filter (WGTD), or a simple low-pass network (FLAT). The exact form of filter selected is dependent on the position of the bandwidth select switch located above it, as follows:

4 kHz (VF); the filters are C-MESSAGE and 3-kHz FLAT respectively.
20-kHz (PROG); the filters are PROGRAM and 15-kHz FLAT.
110-kHz (WIDEBAND); the filters are 50 kb/s and 50 kHz FLAT.

6 **Clear:** Pushbutton switch resets impulse noise counters and timer to zero. The test continues to run as long as the function is selected. The red LED in the switch blinks when the test is running.

7 **Time:** The three position switch selects the duration of the impulse noise test. Continuous, 15 minute, and 5 minute selections are available.

8 **Threshold:** This dual, concentric, decade switch selects the impulse noise threshold. The outer switch has 10 dB increments, from 40 to 90 dBrn; the inner switch has 10 one dB increments for a total range of 40 to 99 dBrn.

9 **Volume:** Controls the gain of the monitor amplifier which drives the internal speaker.

Reference	Name	Function *(continued)*

Transmitter

10 **Oscillator:** Three oscillator modes are provided. The 1004 position of the switch selects a standard 1004 Hz test tone; the QUIET position mutes the transmitter but retains the line termination; the OSC-P/AR-RL mode selects a variable frequency generator, a standard P/AR signal, or the return loss signal if these functions have been selected by control 4.

11 **Bandwidth:** This switch controls the frequency range of the TUNE control and also preselects the noise filter. In the 4-kHz position, the frequency range is 50 Hz to 4 kHz; in the 20-kHz position the frequency range is 3 to 20 kHz; in the 110-kHz position the range is 15 to 110 kHz.

12 **Tune:** Continuously variable control is used to tune the generator to the desired frequency. This control is active when the oscillator control is in the OSC position and the Level function has been selected.

13 **Level:** Continuously variable control sets the generator output level.

Line Interface

14 **Receiver Termination:** Selects either a TERM or a BRDG condition for the receive line. The bridging impedance of the 704A is approximately 25k Ohms.

15 **Impedance:** Selects impedance of the receiver (inner control), and the transmitter (outer control). Selections are 135, 150, 600, 900, and 1200 Ohms.

Power

16 **Power switch:** The set is operated from AC power when the switch is in the DOWN position (green indication), and from internal batteries when in the UP position (red indication). Charging current is applied to the batteries whenever the set is plugged in.

17 **Power Indicator:** This two color LED is on whenever the set is powered up. The indication is red when batteries are in use and green when AC power is being used. A LOW BATTERY alarm is provided by flashing the red LED.

2.2 Rear Panel Description

The rear panel contains only an AC power module. This includes a fuse and a voltage selector card. The power supply is designed to operate from either 120 or 240 VAC. A 250 mA fuse is used for 115 VAC operation.

2.3 710B Controls and Indicators

The front panel of a 710B Network Access Unit is shown in figure 2. The following description groups the controls and indicators as follows; Set-up, Supervision, Interface, and Power.

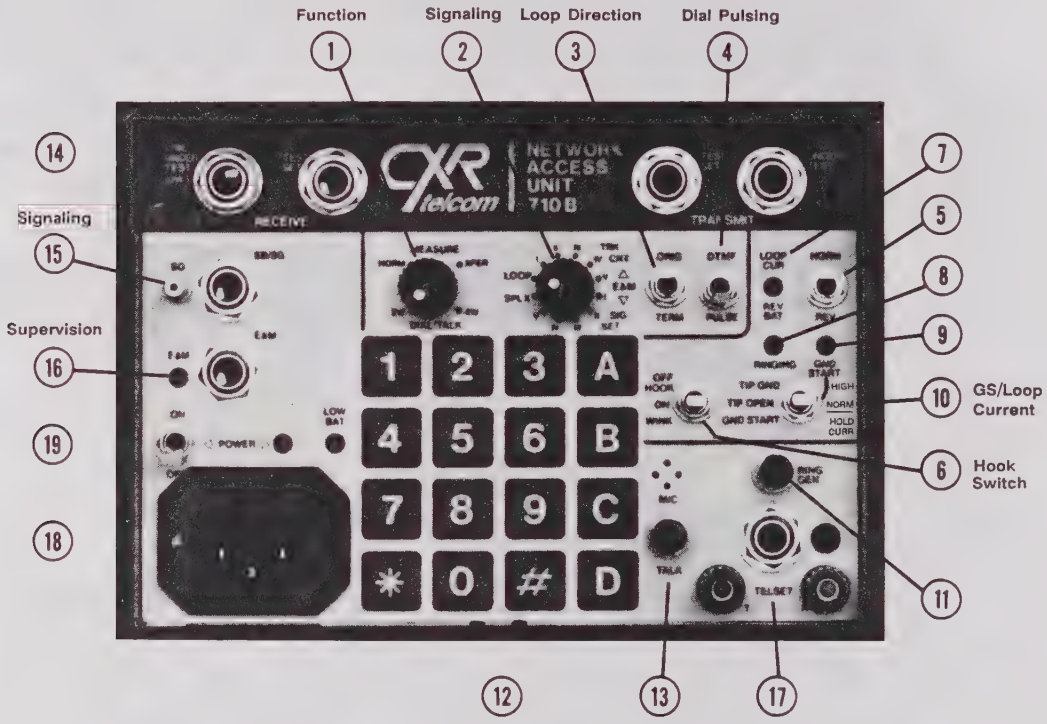


Figure 2. 710B Network Access Unit

Reference	Name	Function

Set-up Controls

1 **Function switch:** The DIAL/TALK positions enable the VF functions of the 710A; the MEASURE positions cut the Line pairs thru to the 701A for testing. In the NORM setting, a 2-wire line (LUT) is connected to the Receive jack of the associated test set; in the XFER position it is switched to the Transmit jack.

2 **Signaling type:** This switch is used to set-up the signaling options:

Loop signaling - ordinary 2-wire C.O. line.
Simplex signaling - loop signaling on a special service 4-wire C.O circuit.
E & M signaling, Trunk - emulates a trunk circuit of a switch. The M-lead transmits signaling and the E-lead receives signaling.
E & M signaling, Signaling Set - emulates a signaling set associated with a facility. E & M signaling is available in all five standard configurations.

Reference	Name	Function *(continued)*

3 **Loop direction:** In the ORIGINATE configuration, the 710B functions as station equipment (it can originate dialing). In the TERMINATE mode, it emulates network equipment (supplies battery). This switch is active for Loop and Simplex configurations.

4 **Dial pulsing:** Either standard DTMF tone dialing or dial pulsing is available. This function is fully active when the unit is configured for Loop or Simplex and Originating mode. Tone signaling is available at all times.

Supervision Controls and Indicators

5 **Battery polarity:** In the NORMAL position, negative battery is applied to the Ring lead. This is limited to 23 mA and is active only in the TERM mode. Battery may be reversed to simulate answer supervision on a loop-dial trunk.

6 **Hook-switch:** OFF-HOOK initiates a seizure towards a switch line circuit or on an E & M trunk. ON-HOOK releases a call. The WINK (momentary) position simulates a start-dial signal when the set is used in a TERM mode. It consists of a 200 msec E-lead Off-hook or battery reversal, depending on the configuration.

7 **Loop Current indicator:** Tri-state LED shows Green for normal loop current and Red for reversed battery. Current flow through the LED illuminates it, thus, approximately 20 mA must flow for a visible indication.

8 **Ringing indicator:** LED indicator shows the presence of ringing voltage on the loop. The threshold is approximately 70 VAC.

9 **Ground Start indicator:** Monitors the Ring lead for ground, i.e. differential current in Tip and Ring leads. Active in LOOP/SIMPLEX, TERMINATE modes.

10 **Ground Start** and **Holding Current control:** This switch has two distinct functions. In the ORIGINATE mode, it controls the holding current at either 20 mA (NORM), or 26 mA (HIGH). It is also used to initiate a call on a ground-start circuit by placing a ground (momentary) on the ring lead. In the TERMINATE mode, the switch controls the tip lead connection. TIP GND is the normal position, TIP OPEN is used at the beginning of a call sequence on a ground-start circuit.

11 **Ringing Generator:** Applies 20 Hz ringing voltage to the loop (TERMINATE mode). Sufficient power to drive a REN 3 load is available.

12 **Dial pad:** Conventional dial pad plus A,B,C,D tones are provided. (The latter are not used in network testing). Pulse dialing uses numeric keys.

13 **Talk:** Push to talk feature is active in all modes. Speech is picked up by internal microphone and coupled to line under test. Listen feature is provided by associated transmission test set.

Reference Name **Function** *(continued)*

Interface Section

14 **Line jacks:** Line jacks are wired T/R/S and are compatible with 310 type telephone plugs. The network access line is connected to the Line Under Test jacks and the transmission test set is connected to the Test Set jacks

15 **Signaling jacks:** These jacks are wired as follows:

Tip:	E	SG,
Ring:	M	SB

Note: Signaling ground may be provided to the unit via the SG lead (Ring) or the SG terminal. If the SB/SG jack is not in use, the third wire on the AC connector is connected to the internal ground via the normally-closed contacts.

16 **E/M indicator:** This red LED shows the status of incoming signaling. ON = off-hook, and OFF = on-hook. (For the TRUNK CIRCUIT mode, the M-lead is monitored; for the SIGNALING SET mode, the E-lead is monitored.

17 **Telset connection:** The Tip and Ring leads of the LUT (2W) jack are connected directly to this jack and also to the T/R terminals. This feature is used for monitoring with a butt-set.

Power

18 **Power connector:** The front panel AC connector fits a standard instrument power cord. The 710B is designed for operation from 120 VAC, 60Hz. The internal batteries are being charged when the unit is connected to AC power and the power switch is OFF.

19 **Power indicator:** This red LED is ON whenever the power switch is turned on, even if external AC is not connected.

Note: Some functions (ringing generator, Loop Terminate mode, Simplex operation, and E & M signaling) operate on AC power only.

2.4 705B Dial and Hold Unit

Reference	Name	Function

1 **Function switch:**

MEASURE: The LINE jacks are connected to the TEST SET jacks with the hold coils disconnected. In the NORMAL position, the connection is direct (Receive to Receive and Transmit to Transmit); in the REVERSE position the connections are swapped (Receive to Transmit and Transmit to Receive).

HOLD & MEASURE: The LINE jacks are connected to the TEST SET jacks with hold coils connected across both lines. In the NORMAL position, the connection is direct (Receive to Receive and Transmit to Transmit); in the REVERSE position the connections are swapped (Receive to Transmit and Transmit to Receive).

DIAL: The selected line (Receive or Transmit) is connected directly to the DIAL jack. The hold function is activated for the non-selected line.

2 **Line jacks:** Connection for Line-under-test.

3 **Test set jacks:** Connection to associated transmission test set.

4 **Dial jack:** Connection for a telset which is required to dial a test number. The type 310 connector is wired Tip/Ring.

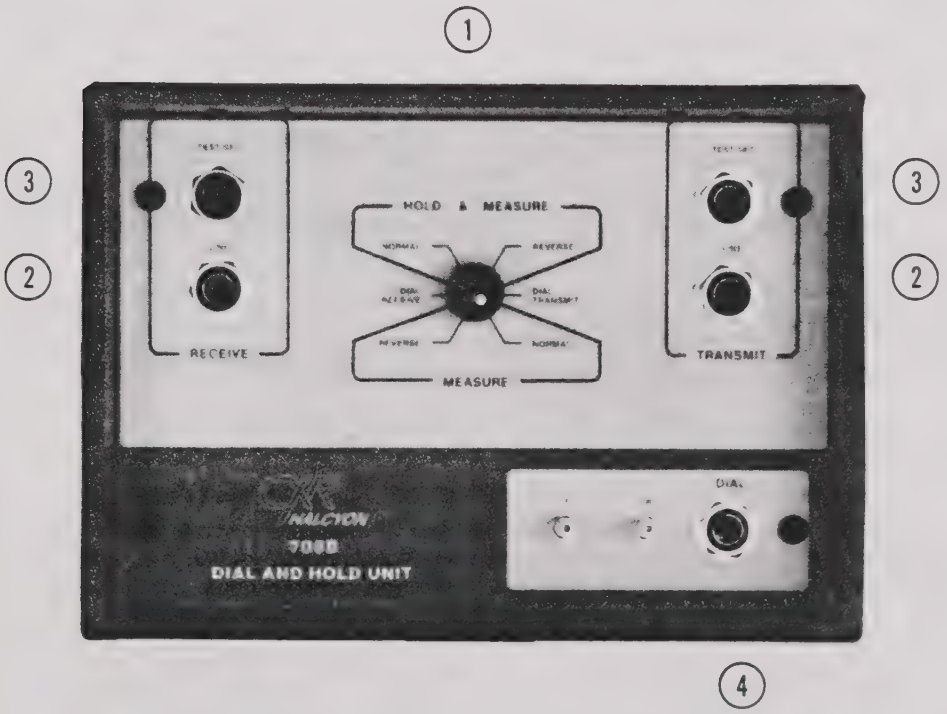


Figure 3. 705B Dial and Hold Unit

2.5 Functional Description

Figures 4 to 6 depict the functional operation of the line interfaces of the 705B and 710B units.

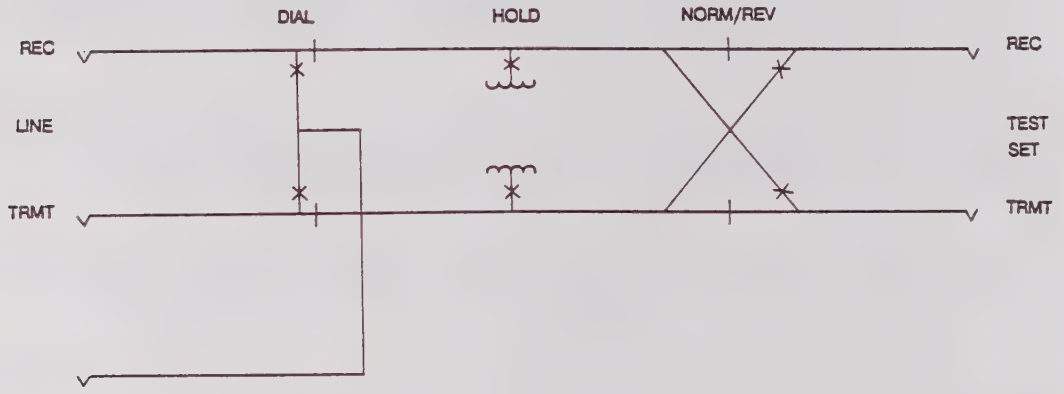


Figure 4. 705B Line Interface

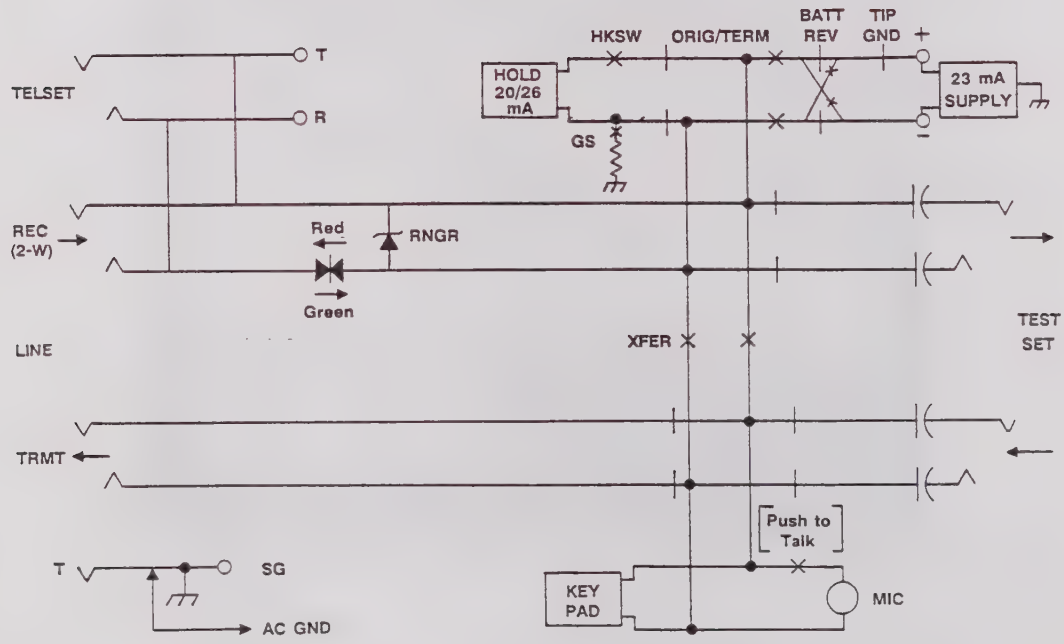


Figure 5. 710B Loop Functions

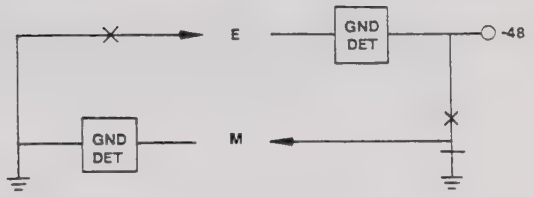
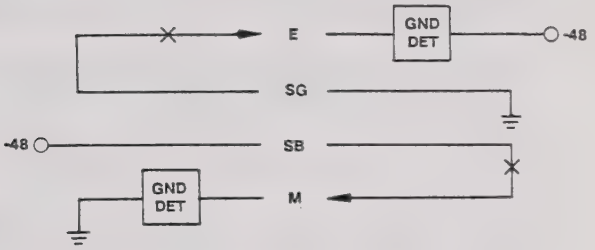
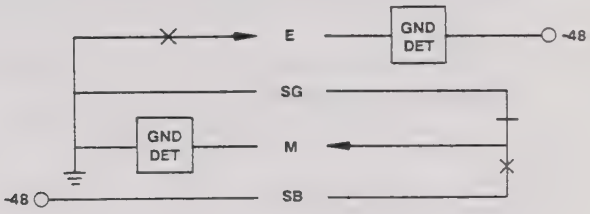
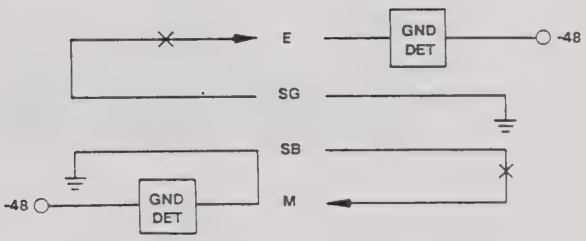
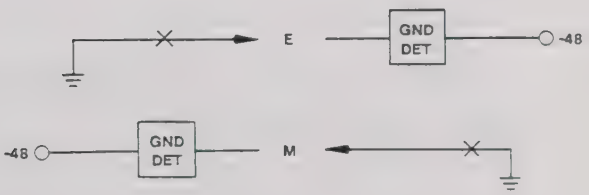
TYPE	STATE (ON/OFF HOOK)	ARRANGEMENT SIGNALING SET TRUNK CIRCUIT
I	E: open/gnd M: gnd/batt	
II	E: open/SG (gnd) M: open/SB (batt)	
III	E: open/gnd M: SG (gnd)/SB (batt)	
IV	E: open/SG (gnd) M: open/SB (gnd)	
V	E: open/gnd M: open/gnd	

Figure 6. E & M Signaling

SECTION 3 - TRANSMISSION LINE MEASUREMENTS

3.1 General Instructions

Preparation for testing includes powering up the test set, presetting controls to match the characteristics of the line, and attaching the set to the line to be tested.

Test set power

Battery Operation: Place the POWER switch in the up position. The red Power Indicator should light.

Caution: The NiCd batteries should NEVER be totally discharged. Turn the set off and recharge the batteries, or operate the set with AC power, when the red LED starts to flash.

Note: The batteries should be cycled through their full operating range periodically. This is necessary to prevent a "memory" of shallow discharge cycles from developing, thus, resulting in a loss of capacity.

AC Power: Place the switch in the down position. The green Power Indicator should light.

Nore: The model 704A test sets are factory set to operate from 120 VAC. This can be changed to 240 VAC by turning over the voltage selector card located in the rear panel AC receptacle using the following procedure:

1) Remove the power cord and slide fuse cover to the left. Remove the fuse, using the FUSE PULL lever.
2) Pull out the voltage selector card. Position the card so that "240" will be visible when the card is inserted, then reinstall.
3) Install an 1/8 Amp SLO blow fuse.

Preset Controls

Display	TRMT
Function	LEVEL
Level	Transmit test tone level
Oscillator	1004
Impedance, Receiver Termination, frequency band, and filter to match channel characteristics.	
705B	MEASURE/Normal

Connect Line

Connect the line to be tested to the RECEIVE and TRANSMIT jacks, or to the associated 710B or 705B unit. Two-wire lines are connected to the RECEIVE jack only.

To dial a test number on a two-wire line (using the 705B unit), proceed as follows:

1) Connect a telephone-set (butt-in) to the Dial jack or terminals of the 705B unit. Set the function switch to DIAL/Receive.
2) Seize the line, monitor for dial tone, and dial the test number.
3) When the line answers, set the function switch to HOLD & MEASURE. Use the Normal position to make measurements (receive), and the Reverse position to transmit test signals.

3.2 Loss Measurement

APPLICATION NOTE

Loss is normally the first measurement made when a channel is to be tested. If this parameter is not within specifications, it is likely that other parameters will also be out of tolerance. The test is made by transmitting a 1004 Hz tone on the channel and measuring the signal level at the receiving end. Circuit loss is calculated by subtracting the measured level (dBm) from the Test Level Point and is stated in dB.

Setting the Transmitter

1) Select TRMT Display and LEVEL Function.
2) Set the Oscillator control to 1004.
3) Adjust the LEVEL to test tone level. For general use, 0 dBm is used frequently; data lines are always tested at -13 dBm0.

Measuring Loss

1) Select RCV Display and the LEVEL Function.
2) Verify that the received frequency is 1004 Hz.
3) Read the received signal level in "dBm".
4) Calculate the difference between the received level and TLP to obtain the circuit loss. For example:

Received level	-3 dBm
TLP	0
Loss	3 dB

3.3 Attenuation Distortion

APPLICATION NOTE

Attenuation Distortion is a measure of the variation in loss versus the frequency of the circuit. For a complete test, readings are taken at 100 Hz increments and are referenced to the circuit loss at 1004 Hz. Gain-Slope is an abbreviated form of this test, with readings taken only at 404 Hz and 2804 Hz.

Setting the Transmitter

1) Select TRMT Display and LEVEL Function.
2) Set the Oscillator control to 1004.
3) Adjust the LEVEL to test tone level.
3) After the loss at 1004 Hz has been measured, select OSC and TUNE the oscillator to the lowest frequency at which the loss is to be measured
4) When this measurement has been completed, TUNE to the next highest frequency. Continue this process until the entire bandwidth has been covered.

Measuring Attenuation Distortion *(continued)*

1) Select RCV Display and LEVEL Funtion.
2) Verify that the received signal is 1004 Hz and read level in dBm. This is the reference value for subsequent readings.
3) Read level when the next frequency is received. Subtract this value from the reference value to obtain attenuation distortion at this frequency. More loss is (+) attenuation distortion, less loss is (-) distortion. Example:

Frequency	Level	Distortion
1004	-12.0	REF
404	-13.2	+1.2
2804	-15.0	+3.0

3.4 Idle Channel Noise Measurement

APPLICATION NOTE

Noise measurements determine the amount of unwanted signal introduced by the transmission channel. Noise can be caused by amplifiers, induction, crosstalk, multiplexing systems, signaling and telegraph equipment, various switching and signaling transients, and noisy power supplies.

Two different types of noise filters are available to shape the noise spectrum. The message filter shapes the response to correspond to the subjective effect of noise. The flat filter has no attention at the low frequency end, thus, is ideal for measuring power influence.

Setting the Transmitter

1) Set the Oscillator switch to QUIET. This terminates the channel properly.

Measuring Idle Channel Noise

1) Select RCV Display and the NOISE Function.
2) Select the message (C-MESSAGE, PROGRAM, 50 kb) noise filter. Read noise in dBrn.
3) Select the Flat noise filter and read noise.

If the two readings are similar, the noise is predominently in the message passband. If the FLAT reading is considerably higher, power line induction may be the cause of the problem.

3.5 Notched Noise (Noise with Tone) Measurement

APPLICATION NOTE

A 1004 Hz holding tone is applied to a channel under test in order to simulate actual working conditions. Such a test tone is essential in evaluating the noise performance of PCM channels. The tone is notched out by a narrow band-elimination filter in the test set prior to making the noise level measurement.

Notched Noise Measurement *(continued)*

The noise-with-tone measurement is normally converted into signal to noise ratio (S/N) in order to determine if the channel meets transmission requirements. This is a simple matter of converting the units (dBrn to dBm) and algebraically subtracting this value from the test tone level. For example, if the noise-with-tone reading is 57 dBrn, and the tone level is -4 dBm, then S/N is:

-4 - (57 - 90) = 29 dB

Setting the Transmitter

1) Select TRMT Display and NOTCH NOISE Funtion.
2) Set the Oscillator control to the 1004 position.
3) Adjust the LEVEL to test tone level

Measuring Notch Noise

1) Select RCV Display and LEVEL Function.
2) Verify that 1004 Hz is being received and measure the level in dBm.
3) Select the NOTCH NOISE mode with the message noise filter. Read the noise in dBrn.
4) Convert the noise value into dBm by subtracting the reading (dBrn) from 90. Subtract this result from the tone level (dBm) to obtain S/N (dB)

3.7 Noise-to-Ground Measurement

The model 700A Noise to Ground Adapter is required in order to make a noise to ground measurement with the 704A test set.

APPLICATION NOTE

Noise-to-ground measures the amount of common mode interference which is present on a channel. Such common mode noise will be converted to metallic noise if there is any unbalance between the two leads and ground. This test is usefull in locating the cause of excessive noise on a channel.

Setting the Transmitter

1) Set the Oscillator Control to QUIET.

Measuring Noise-to-Ground

1) Connect a test cable to the line under test. This cable must have a ground lead which should be connected to frame ground.
2) Plug the other end of the test cable into the 700A input jack.
3) Insert the 700A plug into the 701A RECEIVE jack.
4) Set the impedance switches on both units to the same value, typically 900 Ohms. The 701A receiver must also be in a BRDG mode.
5) Select RCV Display, NOISE Function, and the flat weighted filter.
6) Read noise (dBrn) and add 40 to obtain the true noise to ground value in dBrn.

3.7 Impulse Noise Test

APPLICATION NOTE

An impulse is a short "spike" of energy which is typically caused by inductive or capacitive coupling into the channel from an outside energy source. Current loop pulsing, power line switching, and transients caused by lightning are typical sources. Impulse noise rarely is severe enough to cause a serious problem to voice communications but even low level impulses can seriously impair data transmission. The test for impulse noise consists of setting a threshold and counting the number of times that signal energy crosses such a threshold in a prescribed period of time. This test is most meaningful when made with a 1004 Hz holding tone on the channel, but it may also be made on an idle line.

Setting the Transmitter

1) For an idle line test, set the Oscillator to QUIET.
2) For a test with holding tone, set the Oscillator to 1004 and adjust Level to test tone level.

Counting Impulse Noise

1) Select RCV Display and IMPULSE NOISE Function.
2) Set the Filter and Band switches to select the specified filter. (C-Message is generally used for VF lines, and 50 kb/s for wideband data lines).
3) Set the THRESHOLD control to the level at which impulses are to be counted. The model 704A has two additional counters, one set 4 dB above the selected threshold and the other set 8 dB above.
4) Set the Time switch for the test duration.
5) If the test is being made with tone, verify that test tone at the proper level is being received.
6) Operate the CLEAR button to start the test. The indicator will start to blink. Elapsed time is shown in the left-hand (red) display.
7) The Threshold indicators (0, +4, +8) will flash during the test as impulses are detected.

Note: The test will not run properly (Time display blanks) if the threshold setting is too close to the background noise level.

8) The indicator in the Clear button will extinguish when the test has timed-out.
9) Use the Up/Down function control to examine the contents of each counter in turn. This can also be done during the test BUT be careful not to move the function cursor outside the IMPLS area.

3.8 Peak-to-Average Ratio (704A2 model only)

APPLICATION NOTE

The P/AR test signal has a complex spectrum with 16 components, ranging in frequency from 140 Hz to 3890 Hz. Transmission impairments (especially envelope delay distortion) tend to distort the phase relationships of the discrete frequencies, resulting in a deterioration of peak to average value of this signal. This test is often used as a benchmark test, rather than as an absolute indication of trouble.

Setting the transmitter

1) Select P/AR Function. (If the P/AR board is not equipped, this test cannot be selected).
2) Set the Oscillator switch to OSC -P/AR.
3) Select TRMT display and verify that Level is set correctly.

Measuring P/AR *(P/AR test continued)*

1) Select the P/AR function and verify that a P/AR signal is being received.
2) Read the value in the left (red) display. The display will show a (+) or (-) sign if the received level is out-of-range.

3.9 Return Loss Test (704A2 model only)

APPLICATION NOTE

Return loss measures the ratio of the transmitted signal which is reflected back toward the signal source. In essence, it is a measure of the quality of the termination. The standard test method is to transmit shaped white noise, measure the reflected power level, and correct this level for transmission losses. Return loss equals the ratio of the transmitted power level to the reflected energy. Three shaping filters are used to cover the mid (ERL), low (SRL), and high (SRH) frequency bands.

The model 704A2 set measures return loss from a four-wire point only. An external hybrid may be used to measure RL at a two-wire point. The set does not incorporate automatic "0 loss" control or transhybrid loss correction settings.

Measuring return loss

1) Select ERL Function. Echo return loss covers the 500 to 2500 Hz band.
2) Set the Oscillator switch to OSC - P/AR.
3) Select the TRMT display and verify that the Level is set correctly. This should be in the range from -10 to -2 dB.
4) Select RCV display. The reflected energy level is measured and shown in the left display.
5) Correct the displayed reading to a zero loss value (add hybrid and transmission losses).
6) The difference between the corrected receive value and the transmitted level equals return loss. For example:

Transmitted level		-10 dBm
Measured level	-44.0 dBm	
Trans-hybrid loss	6.5 dB	
Transmission losses	3.5 dB	
Corrected level		-34 dBm
Return Loss		24 dB

7) Select SRL and SRH in turn to read singing return loss-low and -high. The level correction calculated for the ERL measurement may be used.

If the termination on the two-wire side is accessable, a more accurate and easier technique is as follows:
5a) Short the two-wire side. This will cause all of the power to be reflected back towards the transmitter. (An open circuit condition has the same effect but is not as reliable).
5b) Record the measured value. This equals 0 dB return loss.
5c) Remove the short and terminate the two-wire side.
6) Read the measured value. The difference from the "0 dB" reading equals return loss.

4 - NETWORK ACCESS PROCEDURES

The model 704A test set is equipped with a front cover which houses certain ancilliary functions. Use of the basic unit (model 705B) is described in section 4.5. The operation of the more complex model 710B is covered in sections 4.1 through 4.4. These sections describe the operation of the unit when accessing the following types of lines:

Loop Start or Ground Start (LS/GS) C.O. lines.
Direct Inward Dial (DID) lines
Trunks with E & M signaling

4.1 LS/GS, Emulating CPE (Equipment)

In this arrangement, the 710B acts as a telephone or PABX trunk circuit. Preset switches as follows:

Function	DIAL, 2/4 wire
Signaling	LOOP (2W) or SPLX (4W)
Loop direction	ORIG
Dial pulsing	DTMF or DP, as required
Hook-switch	ON HOOK
GS/current	NORM
Loop voltage	not used

Connect the 710B to the test set and to the line to be tested. **The 710B must be grounded properly, via the SB lead/terminal or by the AC line, in order to access a ground start line.**

Turn power ON, the POWER indicator should be illuminated. All two-wire loop tests in this group can be done using the internal rechargeable batteries.

Outgoing Call

1) Place the hook-switch in the OFF-HOOK position. A Loop Current (red) indication shows that the (LS) line has been seized. To seize a GS line, depress the loop current switch to the GRD START position momentarily. This places a resistance ground on the Ring lead.
2) If the line cannot be seized, place the loop current switch in the HIGH position. This raises the holding current from 20 mA to 26 mA.
3) Dial the test number and use the speaker in the TTS to monitor call progress.
4) If the C.O. provides answer supervision to the CPE, the Loop Current indicator will turn green to show reversed battery.
5) Place the function switch in the MEASURE/NORM position and proceed with testing. A two-wire line can be swapped from the Receiver to the Transmitter using the XFER position.
6) A dialed connection may be terminated by placing the hook-switch in the ON-HOOK position.

Incoming Call

1) Initiate a call to the line which is connected to the 710B.
2) The RINGING LED illuminates during the ringing cycle. (The 710B does not monitor for Tip ground which is provided by a ground-start line circuit).
3) Answer the call by placing the hook-switch in the OFF-HOOK position.
4) Testing may proceed with the function switch in the MEASURE position.

4.2 LS/GS, emulating C.O. (Line Circuit)

The 710B takes the place of the C.O., or other equipment, line circuit in this arrangement. Preset switches as shown: (Controls not listed are not used in this mode).

Function	DIAL, 2/4W	
Signaling	LOOP (two-wire only)	
Loop direction	TERM	
Loop battery	NORM	
GS/hold current	LS: TIP GND	GS: TIP OPEN

Connect 710B to the test set and to the line to be tested. A proper ground is neccessary for testing ground start circuits.

Outgoing Call (CPE to Network)

1) Operate the ground start control at a GS station. The GND START LED on the 710B lights.
2) Switch GS to TIP GND. This extinguishes the light.
3) Condition the station equipment to off-hook. This will draw loop current from the 710B, thus illuminating the LOOP CURRENT indicator (green)
4) Set the loop battery to REVERSE. The station equipment should recognize this as an answer supervision.
5) Select MEASURE/NORM to conduct transmission testing using the attached TTS. If this set does not have a port transfer function, use the MEASURE/XFER position to transmit on a 2-wire connection.

Incoming call (Network to CPE)

1) Set the GS switch to TIP GND. The station equipment should recognize this as a line seizure.
2) Operate the RING GEN key on the 710B to simulate ringing.
3) The LOOP CUR LED (green) will light when the station answers the call.
4) Set the Function switch to MEASURE and proceed with transmission testing.

4.3 Direct Inward Dialing Trunk

DID trunks tie a PBX directly into the national numbering plan since stations are dialed directly from outside (not intercepted by an attendant). Such trunks are one-way, incoming to the PBX, thus, are virtually identical to Loop Start lines except reversed in direction.

Emulate PBX

1) Preset switches as listed in section 4.2 (emulate Line Circuit, loop-start mode).
2) Seize trunk at C.O. end. Loop current indicator lights (red) to show normal current flow.
3) Send WINK to simulate start dial signal.
4) Set Loop polarity switch to REVERSE to simulate answer supervision.
5) Set the function switch to MEASURE and proceed with transmission testing.

Emulate C.O. Switch *(DID testing continued)*

1) Preset switches as listed in section 4.1 (emulate Station Equipment, loop-start mode).
2) Place the hook-switch in the OFF HOOK position. The loop current indicator lights (red) to show normal loop current.
3) Observe the momentary REVERSE battery signal (green) to show "wink" from PBX.
4) Dial the test number.
5) Observe answer supervision signal (green loop current indication).
6) Set function switch to MEASURE and proceed with transmission testing.

4.4 E & M Signaling

E & M signaling provides full-capability unidirectional signaling on tie trunks between PBX's. Of the five different arrangements shown in figure 6, Type I is the most common. Preset switches as follows:

Function	DIAL/TALK
Signaling	TRK CKT to emulate a switch, or SIG SET to emulate a facility terminal; Type I, II, III, IV, or V to match trunk
Dial Pulsing	As required
Hook-switch	ON HOOK

Connect the line and the test set to the 710B. Connect signaling jacks as required.

Outgoing Call

1) Initiate a call from the 710B by placing the hook-switch OFF HOOK.
2) Monitor the supervision light for far-end dial control (wink or stop-dial).
3) Dial the test number. The E & M supervision lamp will light to show answer supervision.
4) Set the function switch to MEASURE and proceed with transmission testing.
5) Terminate the call by placing the hook-switch ON HOOK.

Incoming Call

1) Monitor the E & M supervision light to show a seizure.
2) Operate the WINK switch if the trunk is set for wink-start. This must be completed within one second of trunk seizure.
3) Incoming pulsing may be observed (E/M) or heard on the test set speaker.
4) Select OFF HOOK to answer the call and proceed with transmission testing.
5) Terminate the call by placing the hook-switch ON HOOK.

Note: Signaling send and receive functions are associated with the E & M leads respectively when the unit is configured as a Signaling Set. The functions are reversed when the unit is set up as a Trunk Circuit.

4.5 Dial and Hold Functions (705B Unit)

The dial and hold functions are used to access C.O. lines, or other dial-up arrangements. The model 705B unit has two independent circuits, thus making it possible to dial and hold two lines.

Dialing

1) Set the function switch to one of the Dial positions.
2) Make the following connections:
   the two-wire dial-up line to the selected LINE jack;
   the TEST SET jacks to the 704A test set;
   a telset to the Dial jack.

The Line is now connected directly to the Dial jack and the test set is disconnected.

3) Dial the test number.
4) Setting the Function switch to Dial will release the hold coil on that side and reconnect the Dial jack. The hold coil on the opposite side remains connected.

Testing

1) To test a line after a number has been dialed, set the function switch to Normal or Reverse. This places a holding coil across the Line jack and disconnects the Dial jack.

Note: The Normal position connects the Line jacks to the Test set jacks located on the same side of the unit. The Reverse positon interchanges the connections to the test set side for side.

2) Conduct transmission testing as required.

5 - SPECIFICATIONS

5.1 704A Transmission Test Set

Oscillator		
	Frequency	50 Hz to 110 kHz, in three ranges 4 kHz: 50 Hz to 4 kHz 20 kHz: 3 to 20 kHz 110 kHz: 15 to 110 kHz
	Fixed frequency	1004 Hz
	Output level	-40 to +13 dBm, (+10 dBm maximum @ 1200 Ohms)
	Flatness	0.1 dB; 200 to 4000 Hz 0.2 dB; 4 to 15 kHz 0.5 dB; 15 to 110 kHz
	Distortion	<-50 dB, 300 to 3000 Hz <-40 dB, other frequencies
P/AR Signal Generator		
	Line spectrum	per section 4.6.2. of IEEE Std. 483
	Output level	-40 to 0 dBm
	Level resolution	1.0 dB
Return Loss Generator		
	Signal	shaped white noise, per IEEE Std. 483
	Filters	ERL: 500 to 2500 Hz SRL: 250 to 500 Hz SRH: 2200 to 3400 Hz
	Level	-10 to -2 dBm
Level/Frequency Measurement		
	Range	-50 to +13 dBm 50 Hz to 110 kHz
	Accuracy	0.1 dB; 1004 Hz, -19 to 0 dBm 0.2 dB; 200 Hz to 15kHz,-30 to 0 dBm 0.3 dB; 200 Hz to 15 kHz, -40 to +13 dBm 0.5 dB; <200 Hz and >15 kHz
	Resolution	0.1 dB 1 Hz to 4 kHz; 10 Hz above 4 kHz
	Detector	averaging
Noise Measurement		
	Modes	Idle line, Notched
	Filters	C-Message, 3-kHz Flat; (4 kHz) Program, 15-kHz Flat; (15 kHz) 50 kb/s, 50 kHz Flat; (110 kHz)
	Notch filter	-50 dB, 995 to 1025 Hz
	Range	10 to 99 dBrn; (idle line) 20 to 99 dBrn; (notched)
	Resolution	1 dB
	Accuracy	1 dB, 20 to 90 dBrn 2 dB, 10 to 20 dBrn
	Detector	quasi-RMS

Noise-to-Ground Measurement (700A Adapter)	
Range	50 to 130 dBrn
Accuracy	1.5 dB
Impedance	100k Ohm, lead to ground
Impulse Noise Counting	
Counters	three; selectable threshold, +4 dB, +8 dB
Counter capacity	999
Threshold selection	40 to 99 dBrn
Threshold resolution	1 dB
Threshold accuracy	1 dB
Timer	5 minutes, 15 minutes, continuous
P/AR Measurement	
Range	0 to 120 units
Accuracy	2 units; 30 to 110
	4 units; 0 to 30 and 110 to 120
Resolution	1 unit
Return Loss Measurement	
Configuration	four-wire
Measurement range	0 to 50 dB
Accuracy	1 dB
Resolution	1 dB
Line Interface	
Impedance	600, 900, 135, 150, 1200 Ohms
Bridging	>20k Ohms
Balance	90 dB at 50 Hz, decreasing 20 dB per decade
Environmental	
Operate temp.	0 to 50°C
Storage temp.	-25 to +75°C
Relative humidity	0 to 90%, non-condensing
General	
Size (approx)	5" x 8.5" x 18" overall
Weight	14 lbs., with 705B
Power	115/230 VAC, 50/60 Hz
	Internal NiCd batteries
Battery cap.	3.5 hours (typical)
Recharge time	approx. 12 hours

5.2 710B Network Access Unit

Interface		
	Loop signaling	2-wire, T/R 4-wire, simplex A/B leads derived from T/R AND T1/R1
	E & M signaling	Types I - V
Supervision		
	Loop	Loop start; ground start Originate or Terminate dialing
	E & M	Trunk circuit; signaling set
Dialing		
	Type	DTMF and pulse
	Pulse rate	10 pps, 60% break, 840 msec IDT
	DTMF	Standard tone pairs
	Keypad	DP; 0 - 9 DTMF; 0 - 9, *, #, A - D
Station Equipment Emulation		
	Holding current	Electronic control, 20 and 26 mA
Line Circuit Emulation		
	Loop battery	Electronic control, 23 mA
	Polarity	NORM: Ring (-) REV: Tip (-)
	Ring generator	20 Hz; 70 VAC; REN 3
Trunk Signaling		
	E & M supervision	- 22 = BATTERY
	Wink	200 msec
General		
	Size	5.1 x 7 x 2.2 inches
	Weight	2.8 pounds
	Battery	NiCd
	Recharge time	approximately 8 hours

5.3 705B Dial and Hold Unit

Hold coils	two, 660 Ohms
Power	none, passive unit
Size	5.1 x 7 x 2.2 inches
Weight	1.5 pounds

All specifications are subject to change without notice.

WARRANTY

Products manufactured by CXR Telcom Corporation are guaranteed to be free of defects in materials and workmanship for a period of one year from the date of shipment. CXR Telcom will accept returned items, transportation prepaid to the service center, for repair during the warranty period at no cost to the customer, provided that the products have not been subjected to improper installation, accident, misuse, neglect, or unauthorized alterations.

Certification

CXR Telcom Corporation certifies that all products are thoroughly tested and inspected and found to meet manufacturers specifications when shipped from the factory.

Inspection

All products manufactured by CXR Telcom are carefully inspected and thoroughly tested prior to shipment. Modern packaging techniques are used to prevent damage during shipment. If goods are received in a damaged condition, A CLAIM SHOULD BE FILED WITH THE TERMINATING CARRIER IMMEDIATELY. Normally, the carrier will want to inspect the shipping carton and packing materials.

Repair Service

If equipment does not operate properly when tested in accordance with the instructions, it should be returned to an authorized service center for repair. **Call or write Customer Service for a Return Material Authorization prior to shipping any equipment to the factory.** When returning equipment for repair, utmost care should be taken to avoid shipping damage. If available, use the original cartons and packing material. Shipping charges should be prepaid.

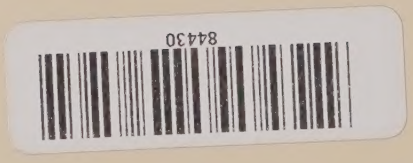
If the equipment is covered by warranty, it will be repaired free of charge or replaced, at the Company's option, and returned prepaid. Unauthorized field repairs or modifications will invalidate the warranty.

For out-of-warranty repair work, Customer Service will provide a quotation for repair charges first, unless the shipment is accompanied by a purchase order. Repair work will be performed after authorization to proceed (in the form of a purchase order) is received.

Service Centers

CXR Telcom Corporation
Attn: Customer Service
521 Charcot Avenue
San Jose, CA 95131
(408) 435-8520
(408) 435-1276 (FAX)

CXR Telcom Corporation
Attn: Customer Service
2960 Woodbridge Avenue
Edison, NJ 08837
(201) 494-8822
(201) 494-8832 (FAX)



CXR telcom

521 Charcot Avenue, San Jose, CA 95131

(408) 435-8520 FAX (408) 435-1276